

Interactive comment on “On the isolation of OC and EC and the optimal strategy of radiocarbon-based source apportionment of carbonaceous aerosols” by Y. L. Zhang et al.

Anonymous Referee #2

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This manuscript presents a method for extracting elemental and organic carbon (EC) and (OC) from aerosol filter samples for subsequent radiocarbon analysis. The methods aims for optimal separation of OC and EC, while minimizing the losses of relatively refractory OC and less refractory EC that cannot be separated.

The tests of the method described in the manuscript are comprehensive and convincing. This method sets a new 'state of the art' in OC/EC separation to which other, simpler methods can be compared. My comments mainly concern the clarity of the manuscript and presentation of the methods and data.

Specific comments:

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P 16660, line 1: “Consequently, ...” Does not follow from the previous sentences. The next sentences could be moved to p 17659, line 6

Section 2.4, p 17666, line 11: How do you determine the OC recovery?

Section 3.1, p 17670, line 21: Please state exactly how the EC yield is defined. There is a general definition in section 2.5, with ATN_t/ATN_0 . Which time t was used for this purpose?

Section 3.2.2, p 17671, line 16: To call the EC that is lost in S2 and S3 “non”-refractory is misleading, especially if it evolves at the same temperature as “refractory” OC. Perhaps a better term could be found.

Section 3.2.4 Please provide additional detail what was done in this comparison. Since OC and EC in the swiss protocol are only collected with around 80% recovery, I am surprised at the 1:1 correlations. Or were the OC and EC amounts corrected to 100% recovery (and if so how was this done)?

Section 3.3 Again please provide a more detailed description of what was done in this comparison. What were the oven temperatures in THEODORE and S2 temperatures? How was the EC recovery determined for the THEODORE method?

Section 3.3 Please provide some extra discussion of the results.

a) Since the THEODORE method does not use a He step, can one conclude that the He step for this filter was not very important in removing OC, or is it rather that the THEODORE method is equally successful in removing OC than step 2 and 3 of the new method combined?

b) I am also not completely convinced about the extrapolation of $f_m(OC)$ to 100% EC yield. If the complete removal of OC is not guaranteed (which seems difficult in the THEODORE protocol), then the increase of $f_m(OC)$ with EC recovery could also stem from small amounts of residual OC. How do you make sure this is not the case? Could this have anything to do with the different slopes between mass yield and optical yield,

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see supplement?

Section 3.4.1: How exactly do you calculate the amount of non-rEC and tEC. How do you calculate tEC and the mass yield without using optical measurements?

Supplement: If you extrapolate the optical yield or the mass yield, you can get quite different results for the final fm(EC). Please comment. Which yield should be used and why. Does the final uncertainty justify the extrapolation (esp. in the THEODORE method) also considering the additional uncertainty about complete OC removal (see comment b section 3.3)?

Conclusions, page 17681, line 15ff: That "...non-fossil EC tends to co-evolve together with refractory OC" is maybe a bit strong statement. From figure 10 it can be seen that the EC that is lost during step 2+3 is still mostly fossil. From Figure 10 I estimate that 20% of the biomass burning EC prematurely evolves during step 2+3, compared to 16% of the fossil EC. This would mean that BB OC is only slightly (but measurably) less refractory than fossil EC.

Minor comments:

P 17659 line 16: "radiocarbon measurements"

P 17659 line 28 f: Better "overestimate of fossil sources"

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 17657, 2012.